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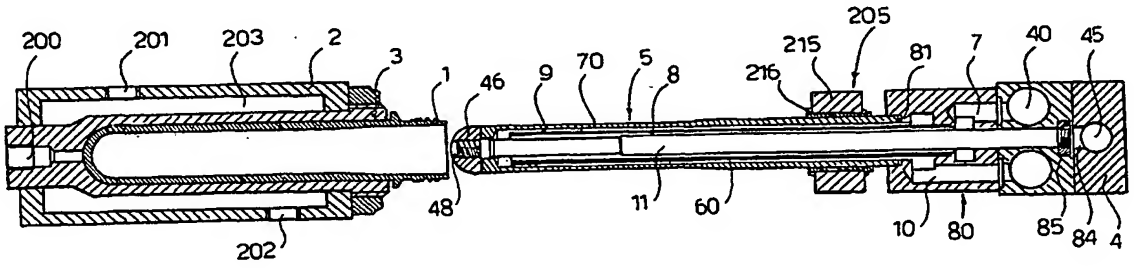
(54) Title: DEVICE AND METHOD FOR COOLING AND EXTRACTING INJECTION–MOLDED HOLLOW BODIES



(57) Abstract

An injection molding machine for production of parisons (1) of thermoplastic material, comprising a carrying device (2) to remove the parisons from the molds and bring them near to a cooling plate (4) comprising nozzles (5); the cooling plate being able to be operated so that said nozzles enter the parisons (1) which are cooled externally by means of heat exchange with the carrying device and internally by means of heat exchange with the nozzles (5); the nozzles (5) and the carrying device (2) being cooled by means of a cooling fluid circulating on the inside thereof and means (205) being provided to eject the parisons, which are collected by a conveyor belt and carried to a storage unit.

DEVICE AND METHOD FOR COOLING AND EXTRACTING INJECTION-MOLDED HOLLOW BODIES

DESCRIPTION

The present invention relates to a device and a method for cooling and extracting injection molded hollow bodies.

The invention refers in particular to a cooling system for those hollow bodies commonly known as parisons made from thermoplastic material such as PS, PC, PVC, PET etc., and destined for those commercial sectors where it is necessary to replace glass because of its high level of fragility, such as for example, containers for cosmetics and toiletries, for medicines and pharmaceutical products, containers for low pH food products, in particular bottles for water and beverages in general, containers for reusable products, containers that have special necks that are too complex to be produced by other methods.

Processing of synthetic resin-based hollow bodies is based on two independent stages: injection molding and blow molding.

In the injection stage synthetic resins are melted from a solid state to a semi-liquid state. The molten material is injected into molds or small cavities in such a way as to take the shape of a small hollow cylinder closed at one end, which forms the parison. These parisons are expelled from the mold, cooled and then sent for storage on a conveyor belt.

The parisons are taken from storage and sent to the second stage of blow molding. In this second stage the parison is heated to a temperature such as to allow it to be stretched and shaped by blowing inside a certain mold, so as to obtain the desired shape. The hollow container, in its final shape, is cooled, stored and is then ready to be placed on the market.

Currently, according to the prior art, the parisons are removed from their molds during the injection stage, at a temperature of about 70° C, by means of a carrying device. This carrying device consists of a plate structure bearing hollow seats into which the parisons are sucked by aspiration. In the carrying device the parisons, in contact with the air, undergo a first cooling, reaching a temperature of about 60°C.

cooling and take-off plate having a plurality of nozzles to receive the parisons. Said nozzles are cooled by making a cooling fluid circulate therein by means of a hydraulic system.

The take-off and cooling plate is translated toward the carrying device in such a way that the nozzles enter into the parisons. The take-off plate is then made to stop in said position, so that each parison simultaneously undergoes internal cooling due to heat exchange with the nozzle of the take-off plate and external cooling due to heat exchange with the carrying device. The take-off plate is then withdrawn, retaining on the nozzles the parisons that have been uniformly cooled and can therefore be ejected by means of special ejectors and sent to storage.

It is clear that the device and method for cooling and extracting injection molded hollow bodies according to the invention presents numerous advantages, allowing the parisons to be cooled internally and externally at the same time.

In fact, not only is better and more uniform cooling of the parisons achieved, but it is also possible to have much shorter cooling times thereof if compared with the cooling times achieved by the machines according to the prior art. This makes it possible to have much shorter cycle times during production and therefore a larger number of pieces produced in the unit of time. The dimensions and bulk of the carrying device and tak-off plate can consequently be reduced to a minimum, resulting in considerable economic advantages, especially in the management of the hydraulic plant and the drive devices of the machine.

Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof, illustrated in the appended drawings, in which:

Figure 1 is a side elevation of the device for cooling and extracting hollow injection molded bodies, according to the invention;

Figure 2A is a section of a carrying device and a cooling and take-off plate, taken along the line II-II in Figure 1;

Figures 2B-2D are sections, as in Figure 2A, illustrating various stages of the cooling and extraction process for hollow injection-molded bodies, according to the invention;

Figure 3 is an exploded view of a cooling nozzle of the cooling and take-off plate.

The cooling and extracting device according to the invention for hollow bodies 1 injection molded by means of a press not shown in the figures will be described with the aid of the appended figures.

A second tubular element 60 having an inside diameter greater than the outside diameter of the first tube 11 is disposed coaxially to the tube 11, so as to create a hollow space or inner duct 8 between the inner surface thereof and the outer surface of the tube 11.

A third tubular element 70 having an inside diameter greater than the outside diameter of the tube 60 is disposed coaxially to the tubes 11 and 60, so as to form a hollow space or outer duct 9 between the inner surface thereof and the outer surface of the tube 60.

The tubes 11 and 70 are fixed in the point of the nozzle 5 by means of a stopper 46 which closes the tube 70 and has a central hole 48 to allow the inside of the tube 11 to communicate with the outside of the stopper 46.

At the end opposite to the point of the nozzle a base 80 is provided in which a circular seat 81 is made such as to house the corresponding end of the tube 70 and more internally a second circular seat 82 housing the corresponding end of the tube 60. A terminal cavity 84 with a smaller diameter allows for passage of the tube 11, which is fixed to the base 80 by means of a nut 85.

Also provided in the base 80 are an inlet duct 7 that allows entry of the cooling fluid into the inner duct 8 of the nozzle and a duct 10 that allows the fluid to leave from the outer duct 9 of the nozzle 5.

The base 80 is destined to engage in a corresponding seat 90 made in the take-off and cooling plate 4. In this manner the tube 11 communicates tightly with a duct 45 made in the plate 4 and connected by means of at least one outer tube 50 (see Figure 1) to a pneumatic system; the duct 7 for entry of the cooling fluid is connected to a duct 40 made in the plate 4 and connected by means of at least one outer tube 50 (see Figure 1) to a pneumatic system; the cooling fluid inlet duct 7 is connected to a duct 40 made in the plate 4 and connected by means of an incoming outer tube 12 to the hydraulic cooling system; the fluid outlet duct 10 is connected to a duct 41 made in the plate 4 and connected by means of a return outer tube 12' to the hydraulic cooling system.

The cooling fluid from the cooling system of the machine is sent to an outer tube 12 that lets it into the duct 40 inside the plate 4; by means of the inlet ducts 7 the fluid enters the duct 8 of the nozzle, then flows into the outermost duct 9 cooling the tube 70. In this manner the parison 1 is cooled internally, its inner surface being in contact with the outer surface of the tube 70.

The parison 1 is then sucked onto the nozzle 5, as shown in Figure 2C and the edge of the neck of the parison abuts against the ejector 205.

At this point cooling of the parison 1 has been completed and, as shown in Figure 2D, the cooling and take-off plate 4 is translated horizontally, drawing away from the carrying device 2.

The take-off plate is then rotated about 90°, placing itself in a horizontal ejection position. In this position the ejector 205 is activated and is made to slide axially on the nozzles 5 ejecting the parisons 1, which fall onto a conveyor belt that carries them to storage. Ejection of the parisons may be aided by a jet of compressed air sent into the channels 45 of the cooling and take-off plate.

Considering that the carrying device can take a number n of parisons 1 from the molds, a cooling and take-off plate 4 can be provided, having a number (n x m) of nozzles in which m is a whole number, so as to form m consecutive sections of nozzles. On start-up, the carrying device 2, at each cycle, positions the parisons in the m consecutive sections of the cooling and take-off plate. Once the cooling and take-off plate has been filled, the parisons relative to the first section, that is the coolest ones that have reached an optimal temperature of 20 °C, are ejected.

a tube (11) connected to the pneumatic system of the machine to retain the parisons, through creation of a vacuum and possibly to eject them by means of a jet of compressed air;
a tube (60) coaxial with said tube (11) and having a greater inside diameter than the outside diameter of said tube (11) so as to create a first duct (8) for passage of a cooling fluid between the outer surface of the tube (11) and the inner surface of the tube (60);
a tube (70) coaxial with said tube (60) having an inside diameter greater than the outside diameter of said tube (60), so as to create a second duct (9) for passage of the cooling fluid between the outer surface of the tube (60) and the inner surface of the tube (70), so as to ensure cooling of the outer surface of said tube (70) that comes into contact with the inner surface of the parison 1.

9. A device according to claim 8, characterized in that inside said cooling and take-off plate (4) at least one duct (45) is provided to connect said tubes (11) of each nozzle to the pneumatic system, at least one duct (40; 41) to connect the ducts (8, 9), respectively, to the hydraulic cooling system.

10. A device according to any one of claims 5 to 9, characterized in that drive means are provided such as to effect a translation of said plate (4) toward the carrying device (2) so that said nozzles (11) enter into said parisons (1) remaining in said position for a suitable time to ensure adequate cooling of the parisons.

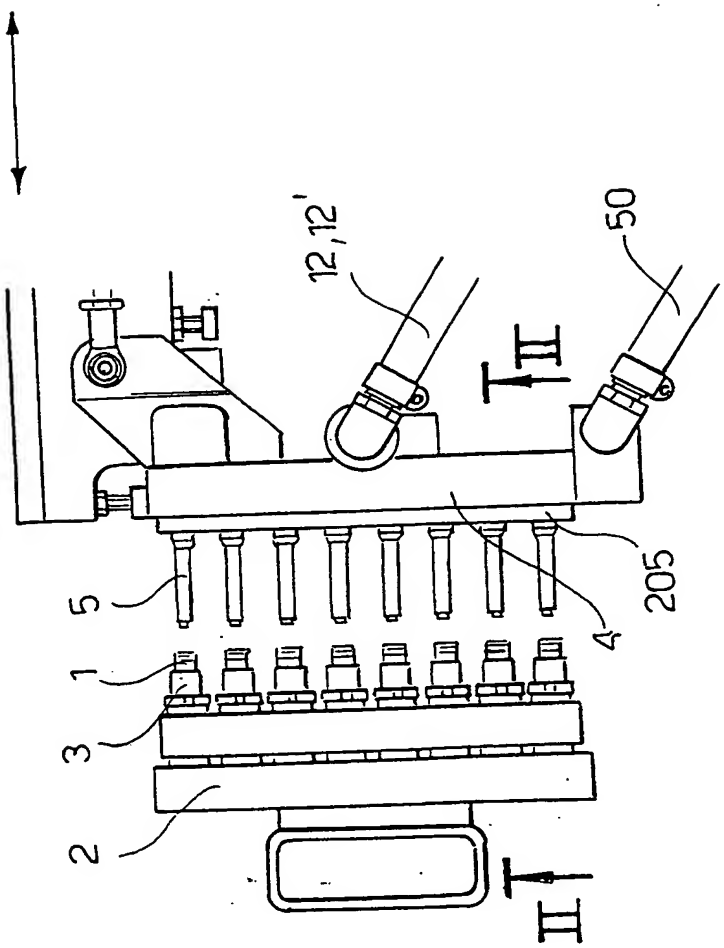
11. A device according to any one of claims 5 to 10, characterized in that ejection means (205) are provided such as to eject said parisons from the nozzles (5) of said plate (4).

12. A device according to claim 11, characterized in that said ejection means (205) comprise a plate (205) interposed between the base of said cooling and take-off plate (4) and the edge of the neck of the parisons (1), said plate (205) being moveable along the axis of said nozzles (5).

13. A method for cooling and extracting injection molded hollow bodies or parisons (1), characterized in that said parisons are simultaneously cooled both internally and externally.

14. A method according to claim 13, comprising the following steps:
opening of the molds from a press and removal of said parisons (1) by a carrying device (2);
movement of said carrying device (2) into a position in register with a cooling and take-off plate (4) having on its surface a plurality of nozzles (5), at least equal to the number of parisons (1) removed by the carrying device (2) at each molding batch;

FIG. 1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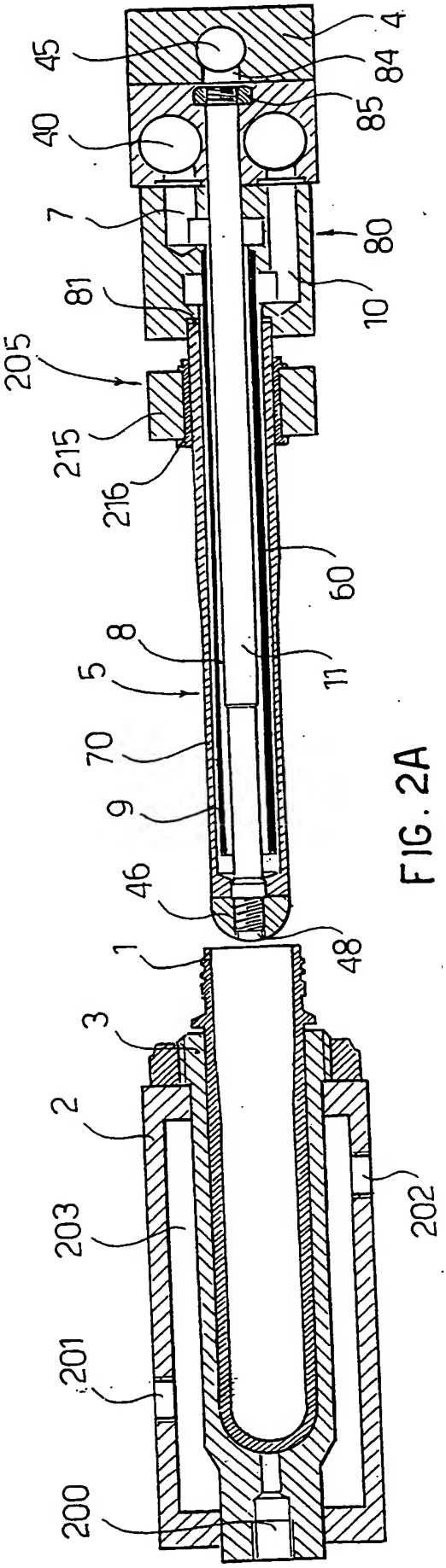
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FIG. 2A

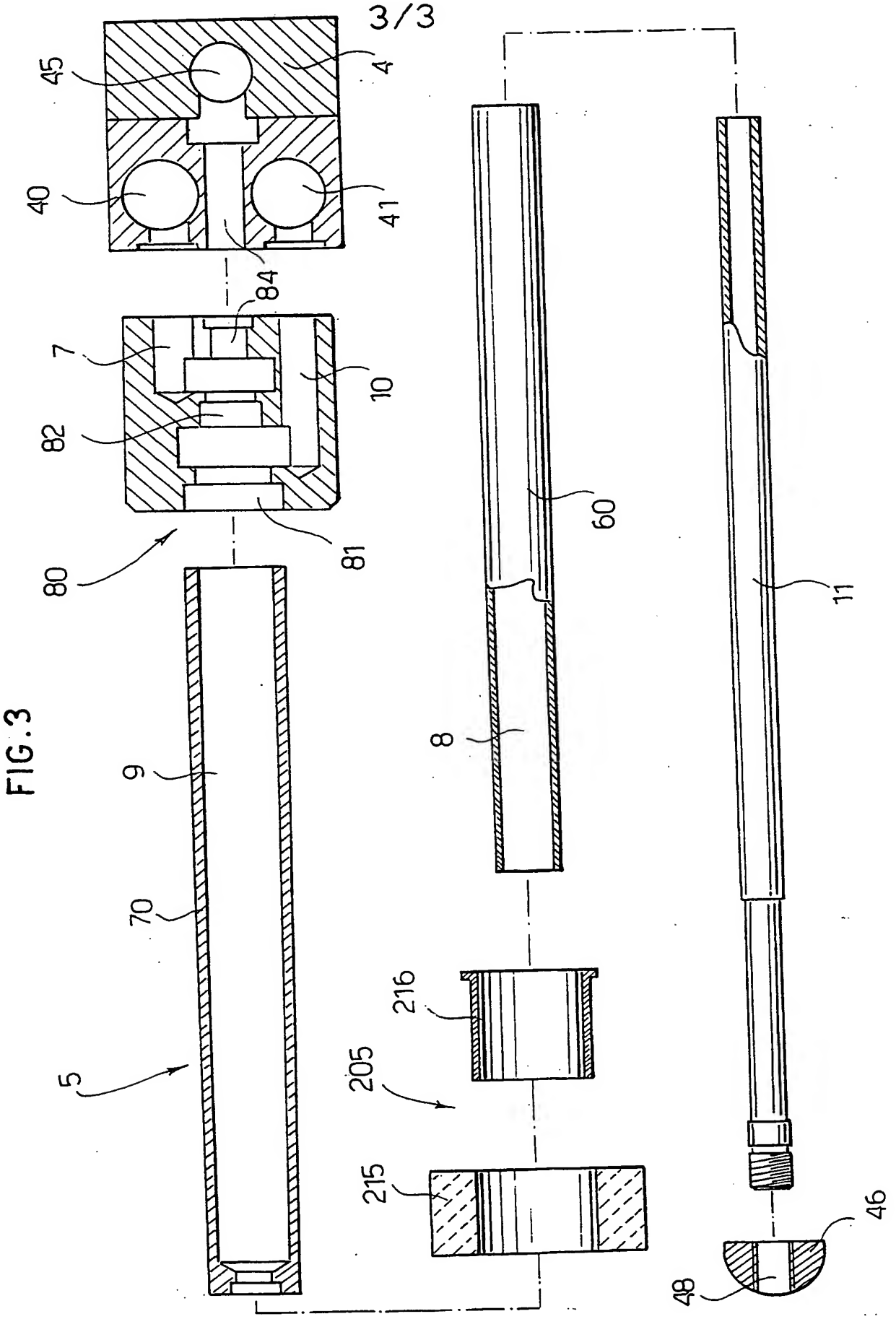

FIG.3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/07650

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 44 25 795 A (KRUPP MASCHINENTECHNIK) 25 January 1996 (1996-01-25) column 7, line 65 -column 8, line 2 column 8, line 41 - line 47; figure 3	3,4
Y	DE 42 12 115 A (KRUPP MASCHINENTECHNIK) 9 June 1993 (1993-06-09) column 10, line 34 - line 43; figure 9	3,4
Y	US 5 631 030 A (BRUN JR CHARLES J ET AL) 20 May 1997 (1997-05-20) column 4, line 22 - line 35	8,9
P,Y	EP 0 937 566 A (BIRAGHI G & CO BM SAS) 25 August 1999 (1999-08-25) column 4, line 33 - line 52; figures 5,6	8,9

Form PCT/ISA/210 (continuation of second sheet) (July 1992)